

Article

Online estimation of gait spatio-temporal parameters using a LRF sensor

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Academic Editor: name

Version February 7, 2017 submitted to Entropy; Typeset by L^AT_EX using class file mdpi.cls

¹ **Abstract:** A single paragraph of about 200 words maximum. For research articles, abstracts should give a pertinent overview of the work. We strongly encourage authors to use the following style of structured abstracts, but without headings: 1) Background: Place the question addressed in a broad context and highlight the purpose of the study; 2) Methods: Describe briefly the main methods or treatments applied; 3) Results: Summarize the article's main findings; and 4) Conclusion: Indicate the main conclusions or interpretations. The abstract should be an objective representation of the article: it must not contain results which are not presented and substantiated in the main text and should not exaggerate the main conclusions.

⁹ **Keywords:** keyword 1; keyword 2; keyword 3. List three to ten pertinent keywords specific to the article, yet reasonably common within the subject discipline.

¹¹ 1. Introduction

¹² The introduction should briefly place the study in a broad context and highlight why it is important. It should define the purpose of the work and its significance. The current state of the research field should be reviewed carefully and key publications should be cited. Please highlight controversial and diverging hypotheses when necessary. Finally, briefly mention the main aim of the work and highlight the main conclusions. As far as possible, please keep the introduction comprehensible to scientists outside your particular field of research. Citing a journal paper [?]. ¹⁷ And now citing a book reference [?].

¹⁹ **2. Background**

²⁰ **3. Methodology**

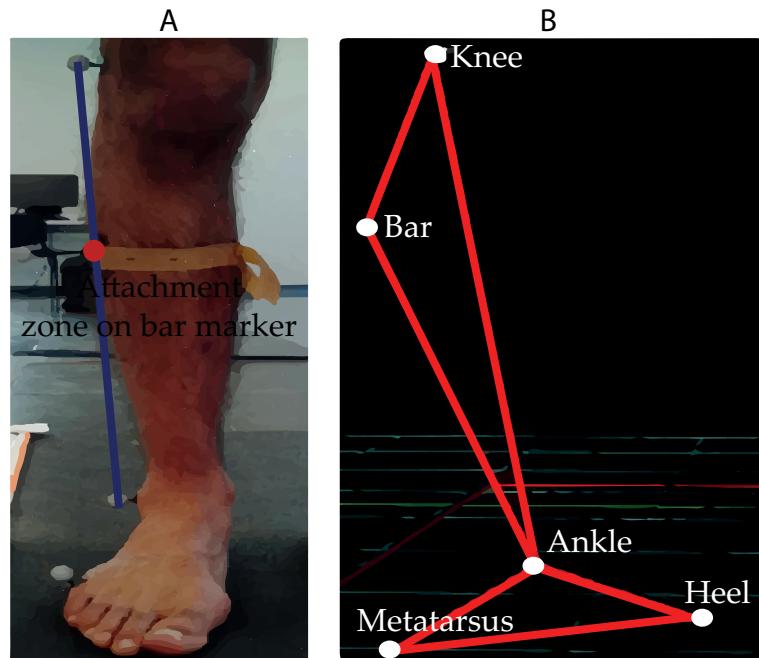


Figure 1. This is a figure

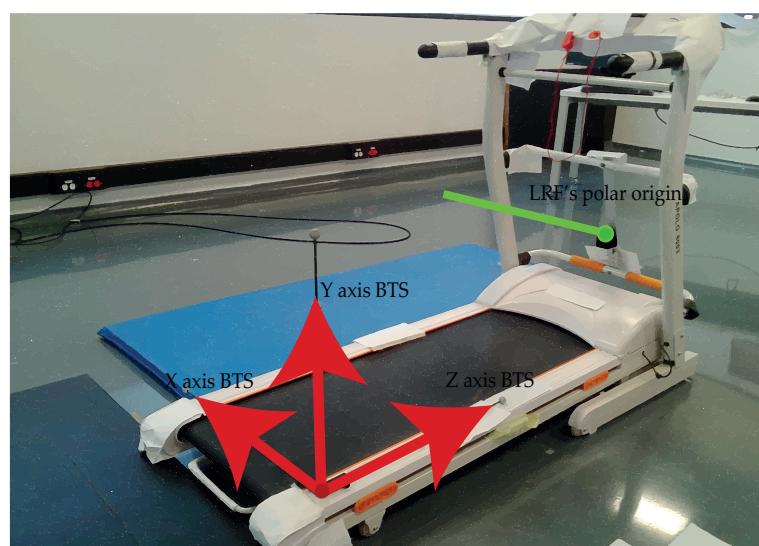


Figure 2. This is a figure

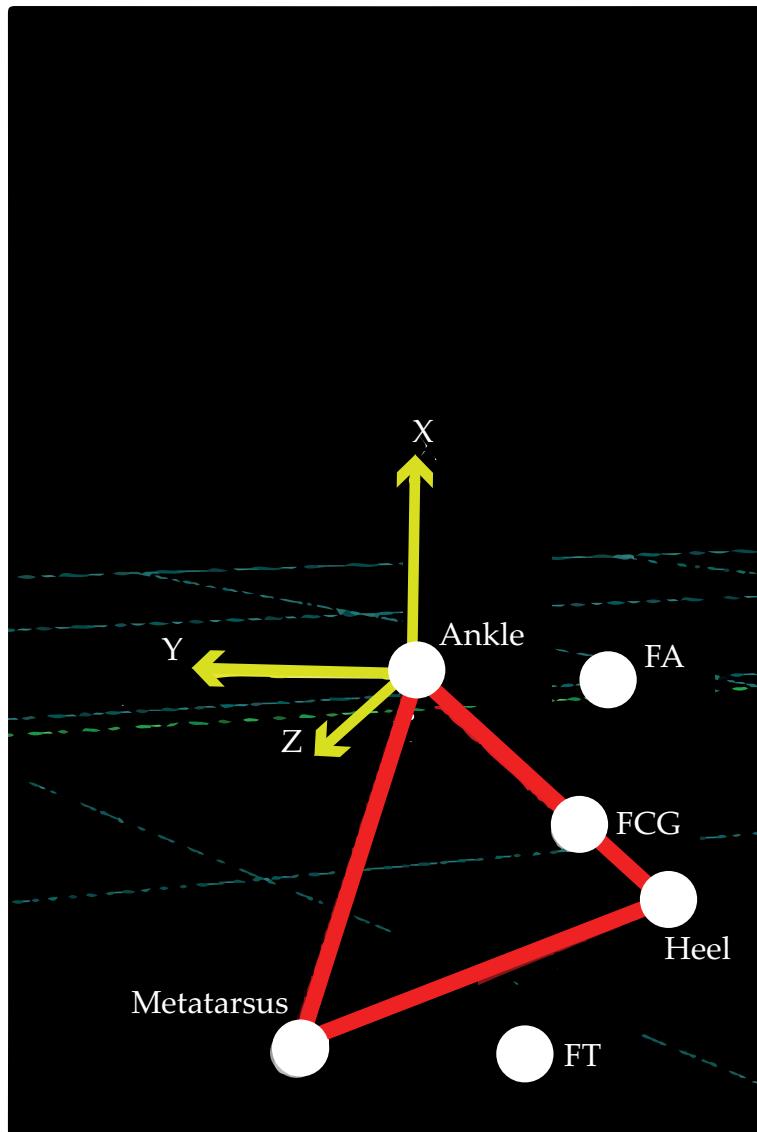


Figure 3. This is a figure

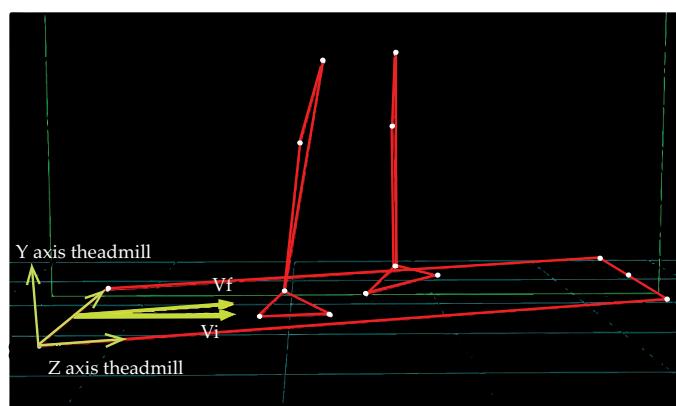
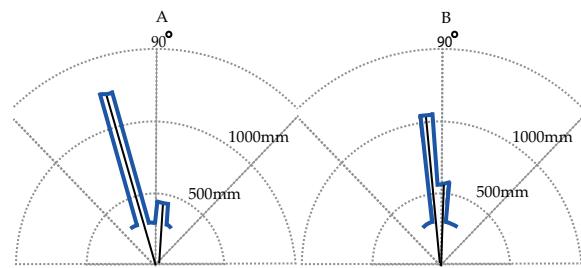
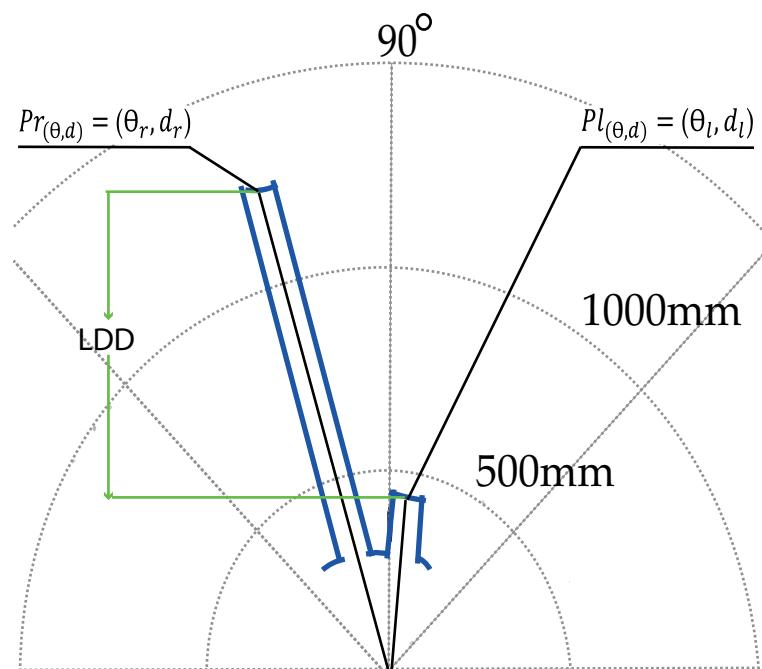
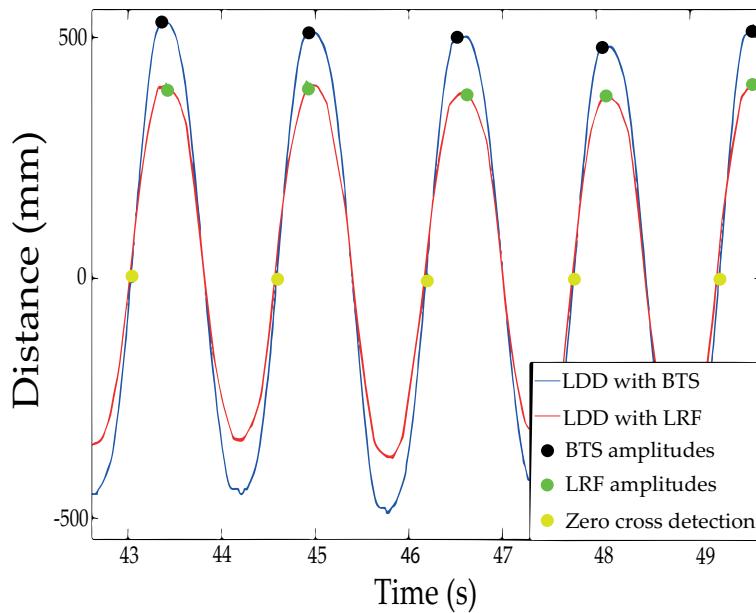


Figure 4. This is a figure

**Figure 5.** This is a figure**Figure 6.** This is a figure

$$LDD = d_l * \sin(\theta_l) - d_r * \sin(\theta_r) \quad (1)$$

**Figure 7.** This is a figure

21 3.1. Subjects

22 3.2. Materials

23 3.3. Protocol

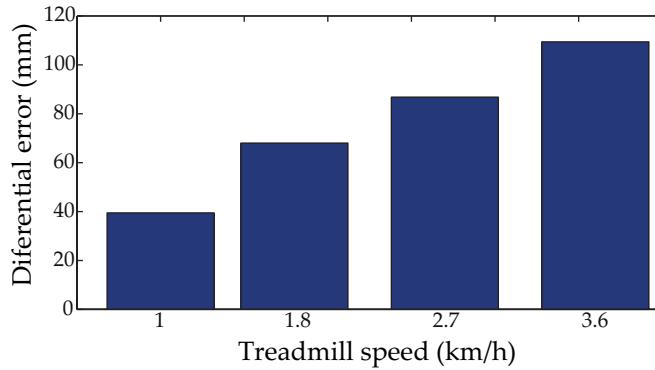
24 3.4. data analysis

25 3.4.1. Laser range finder

26 3.4.2. Six-camera system

27 **4. Results****Table 1.** Samples' Descriptive statics and results of the Wilcoxon test on the 18 initial tests without inclination (* Samples that have medians significantly different)

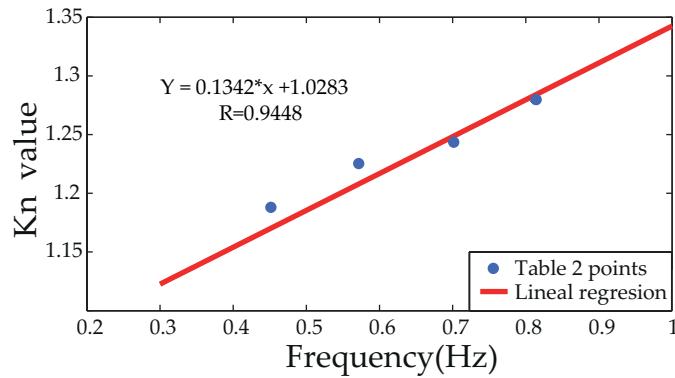
Treadmill speed	Parameters	Cameras	LRF	P value
1 Km/h	Frequency (Hz)	0.410 ± 0.089	0.412 ± 0.066	0.832
	Amplitude (mm)	304.307 ± 50.828	264.583 ± 40.085	$8.752 * 10^{-5*}$
1.8 Km/h	Frequency (Hz)	0.553 ± 0.079	0.5753 ± 0.1487	0.312
	Amplitude (mm)	390.940 ± 49.495	322.194 ± 41.229	$1.3056 * 10^{-7*}$
2.7 Km/h	Frequency (Hz)	0.646 ± 0.080	0.656 ± 0.118	0.580
	Amplitude (mm)	450.696 ± 50.616	362.641 ± 38.304	$3.8631 * 10^{-10*}$
3.6 Km/h	Frequency (Hz)	0.743 ± 0.084	0.735 ± 0.099	0.583
	Amplitude (mm)	509.400 ± 40.887	398.507 ± 37.980	$7.3638 * 10^{-14*}$

**Figure 8.** This is a figure

$$K_n = \frac{M_{CN}}{M_{LN}} \quad (2)$$

Table 2. Frequency's mean in each speed and values of the constant K to adjust the signal's amplitude

Treadmill speed (Km/h)	CM (Hz)	K
1	0.451	1.188
1.8	0.572	1.225
2.7	0.699	1.245
3.6	0.812	1.2794

**Figure 9.** This is a figure

$$K_{cadence} = 0.1343 \text{ Hz}^{-1} * (\text{Cadence}) + 1.0283 \quad (3)$$

Table 3. Descriptive statics of the amplitudes detected (on the first group of volunteers) with the cameras' system and the LRF applying the model to adjust amplitude on LDD signals, and results of the Wilcoxon test

Treadmill speed	Parameters	Cameras	LRF	P value
1 Km/h	Amplitude Adjusted (mm)	304.307 ± 50.828	310.246 ± 44.430	0.679
1.8 Km/h	Amplitude Adjusted (mm)	390.940 ± 49.495	395.470 ± 46.5700	0.653
2.7 Km/h	Amplitude Adjusted (mm)	450.696 ± 50.616	460.431 ± 44.836	0.211
3.6 Km/h	Amplitude Adjusted (mm)	509.400 ± 40.887	512.8487 ± 43.9151	0.574

Table 4. This is a table caption. Tables should be placed in the main text near to the first time they are cited.

Treadmill speed	Parameters	Cameras	LRF	P value
1 Km/h	Frequency (Hz)	0.5358 ± 0.1421	0.5335 ± 0.1551	0.8612
	Amplitude (mm)	294.948 ± 34.828	249.659 ± 28.249	0.0020*
1.8 Km/h	Frequency (Hz)	0.6035 ± 0.0933	0.6134 ± 0.1179	0.6072
	Amplitude (mm)	388.898 ± 32.323	313.322 ± 33.836	1.3257 * 10 ⁻⁷ *
2.7 Km/h	Frequency (Hz)	0.6615 ± 0.0851	0.6661 ± 0.0996	0.7422
	Amplitude (mm)	472.610 ± 38.573	365.942 ± 41.832	1.2226 * 10 ⁻⁹ *
3.6 Km/h	Frequency (Hz)	0.7600 ± 0.0756	0.7572 ± 0.0967	0.7439
	Amplitude (mm)	542.592 ± 36.286	416.863 ± 39.197	1.5641 * 10 ⁻¹⁰ *

Table 5. This is a table caption. Tables should be placed in the main text near to the first time they are cited.

Treadmill speed (Km/h)	Amplitude using cameras (mm)	Amplitude adjusted using LRF (mm)	P value
1	294.948 ± 34.828	293.597 ± 29.428	0.9218
1.8	388.898 ± 32.323	383.189 ± 39.339	0.8457
2.7	472.609 ± 38.573	461.509 ± 47.787	0.5703
3.6	542.592 ± 36.286	539.664 ± 46.208	0.7960

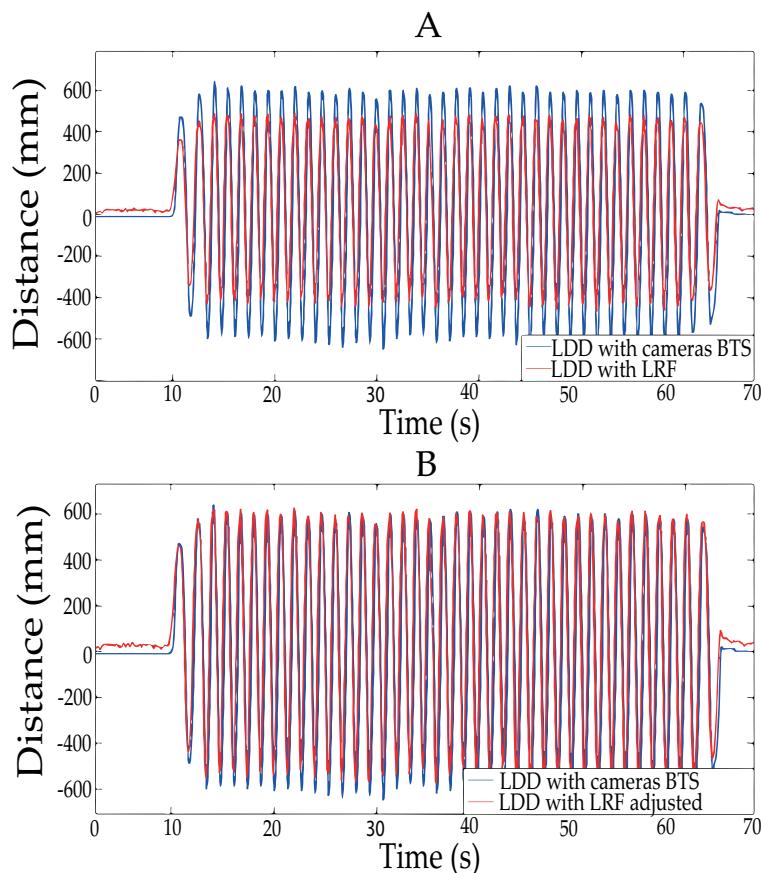


Figure 10. This is a figure

Table 6. This is a table caption. Tables should be placed in the main text near to the first time they are cited.

Treadmill speed	Parameters	Cameras	LRF	P value
1 Km/h	Frequency (Hz)	0.4479 ± 0.0704	0.4509 ± 0.0695	0.3036
	Amplitude (mm)	365.429 ± 55.134	307.596 ± 37.492	$1.82 * 10^{-5}*$
1.8 Km/h	Frequency (Hz)	0.5698 ± 0.0569	0.5716 ± 0.0595	0.3532
	Amplitude (mm)	454.578 ± 48.606	358.824 ± 41.692	$1.22 * 10^{-5}*$
2.7 Km/h	Frequency (Hz)	0.6911 ± 0.0620	0.6985 ± 0.0594	0.6553
	Amplitude (mm)	534.603 ± 42.882	416.796 ± 39.615	$5.95 * 10^{-5}*$
3.6 Km/h	Frequency (Hz)	0.7960 ± 0.0655	0.8007 ± 0.0539	0.0945
	Amplitude (mm)	597.837 ± 40.449	460.653 ± 43.004	$4.01 * 10^{-5}*$

Table 7. This is a table caption. Tables should be placed in the main text near to the first time they are cited.

Treadmill speed (Km/h)	Amplitude using cameras (mm)	Amplitude adjusted using LRF (mm)	P value
1	365.429 ± 55.134	359.824 ± 47.274	0.8864
1.8	454.578 ± 48.606	446.002 ± 42.181	0.1742
2.7	534.603 ± 42.882	522.621 ± 43.694	0.1084
3.6	597.837 ± 40.449	593.009 ± 46.450	0.8328

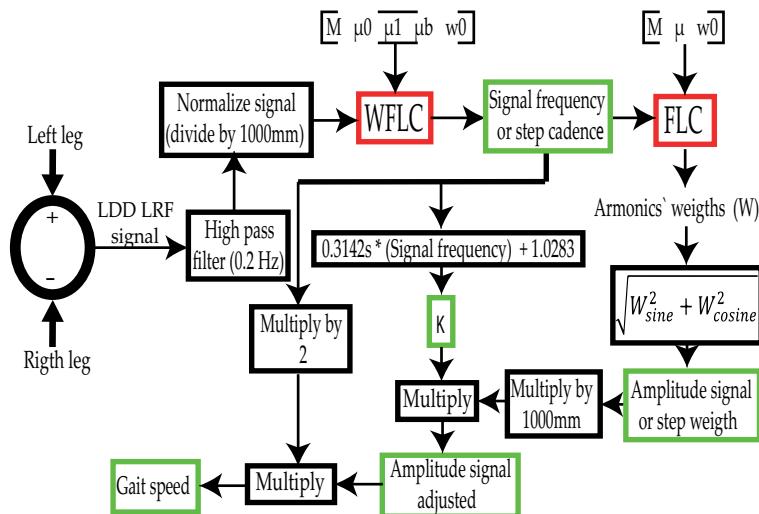
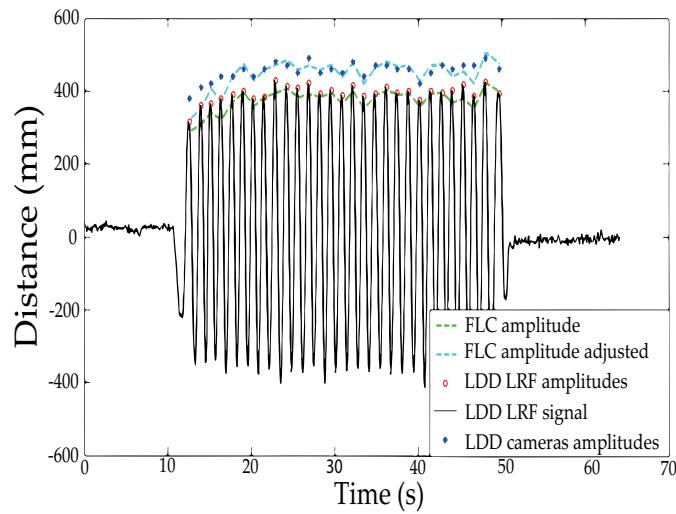
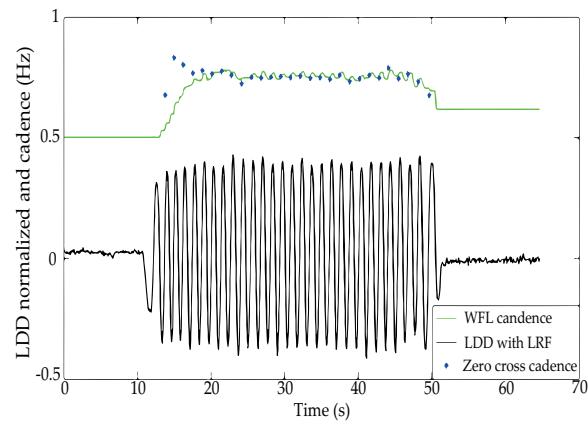


Figure 11. This is a figure

**Figure 12.** This is a figure**Figure 13.** This is a figure**Table 8.** This is a table caption. Tables should be placed in the main text near to the first time they are cited.

Treadmill speed	Parameters	Cameras	LRF applying WFLC and FLC with the adjustment	P value
1 Km/h	Frequency (Hz)	0.4110 ± 0.0594	0.4051 ± 0.060	0.8927
	Amplitude (mm)	300.019 ± 45.885		
1.8 Km/h	Frequency (Hz)	0.5673 ± 0.0442	0.5823 ± 0.0289	0.1858
	Amplitude (mm)	384.577 ± 43.523		
2.7 Km/h	Frequency (Hz)	0.6910 ± 0.0535	0.6908 ± 0.0458	0.8039
	Amplitude (mm)	453.444 ± 48.858		
3.6 Km/h	Frequency (Hz)	0.7947 ± 0.0460	0.7844 ± 0.0295	0.6848
	Amplitude (mm)	513.233 ± 43.193		

²⁸ Please punctuate equations as regular text. Theorem-type environments (including propositions,
²⁹ lemmas, corollaries etc.) can be formatted as follows:

³⁰ **Theorem 1.** *Example text of a theorem.*

³¹ The text continues here. Proofs must be formatted as follows:

³² **Proof of Theorem 1.** Text of the proof. Note that the phrase ‘of Theorem 1’ is optional if it is clear
³³ which theorem is being referred to. □

³⁴ The text continues here.

³⁵ 5. Discussion

³⁶ This section may be divided by subheadings. Authors should discuss the results and how they
³⁷ can be interpreted in perspective of previous studies and of the working hypotheses. The findings
³⁸ and their implications should be discussed in the broadest context possible. Future research directions
³⁹ may also be highlighted.

⁴⁰ 6. Conclusions

⁴¹ This section is not mandatory, but can be added to the manuscript if the discussion is unusually
⁴² long or complex.

⁴³ **Supplementary Materials:** The following are available online at www.mdpi.com/link, Figure S1: title, Table S1:
⁴⁴ title, Video S1: title.

⁴⁵ **Acknowledgments:** All sources of funding of the study should be disclosed. Please clearly indicate grants that
⁴⁶ you have received in support of your research work. Clearly state if you received funds for covering the costs to
⁴⁷ publish in open access.

⁴⁸ **Author Contributions:** For research articles with several authors, a short paragraph specifying their individual
⁴⁹ contributions must be provided. The following statements should be used “X.X. and Y.Y. conceived and
⁵⁰ designed the experiments; X.X. performed the experiments; X.X. and Y.Y. analyzed the data; W.W. contributed
⁵¹ reagents/materials/analysis tools; Y.Y. wrote the paper.” Authorship must be limited to those who have
⁵² contributed substantially to the work reported.

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⁵⁹ the writing of the manuscript, and in the decision to publish the results”.

⁶⁰ Abbreviations

⁶¹ The following abbreviations are used in this manuscript:

⁶²
⁶³ MDPI: Multidisciplinary Digital Publishing Institute

⁶⁴ DOAJ: Directory of open access journals

⁶⁵ TLA: Three letter acronym

⁶⁶ LD: linear dichroism

⁶⁷ Appendix A.

⁶⁸ The appendix is an optional section that can contain details and data supplemental to the main
⁶⁹ text. For example, explanations of experimental details that would disrupt the flow of the main
⁷⁰ text, but nonetheless remain crucial to understanding and reproducing the research shown; figures of
⁷¹ replicates for experiments of which representative data is shown in the main text can be added here if
⁷² brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added
⁷³ as an appendix.

⁷⁴ **Appendix B.**

⁷⁵ All appendix sections must be cited in the main text. In the appendixes, Figures, Tables, etc.
⁷⁶ should be labeled starting with 'A', e.g., Figure A1, Figure A2, etc.

⁷⁷ **References**

- ⁷⁸ 1. Lastname, F; Author, T. The title of the cited article. *Journal Abbreviation* **2008**, *10*, 142-149.
⁷⁹ 2. Lastname, F.F; Author, T. The title of the cited contribution. In *The Book Title*; Editor, F, Meditor, A., Eds.;
⁸⁰ Publishing House: City, Country, 2007; pp. 32-58.

⁸¹ **Sample Availability:** Samples of the compounds are available from the authors.

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